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THE SLUMP

Producers occasionally report drops in milk production when switching to new crop corn silage in the fall. This article by Dr. Mike Allen (Michigan Dairy Review 1997, 2(4): 1-2) looks at why this happens and presents strategies for avoiding and/or minimizing the drop. The article is reprinted with the permission of the Michigan Dairy Review.

Milk production often drops when cows are switched to "new" corn silage; that has been harvested recently and has completed fermentation. The drop seems greater for herds feeding high levels of corn silage, and high producing cows may be affected the most. The drop corresponds with the appearance of undigested kernels in the manure and may not be related to a decrease in dry matter intake. This phenomenon is more prevalent some years than others, but most of the time it clears up as time passes and is not noticeable by mid-winter.

Some nutritionists discount the energy content of the corn silage to account for the passage of undigested corn kernels, but they can rarely adjust rations enough; often, only time can restore the milk yield loss fully. I have come to call this phenomenon the "new corn silage slump". The following is a description of the problem and a few possible solutions.

Why do kernels pass undigested? Even when corn silage is harvested at the recommended moisture content (65 to 70% for horizontal silos and 60 to 65% for vertical silos), kernels can become quite hard and resistant to breakage and digestion. At harvest, kernels are much drier than stover; at 65% whole plant moisture, stover averages about 75% moisture, while kernels average only 40 to 50% moisture. When silage is harvested drier, the kernels become even harder and more resistant to digestion.

Why does the slump go away? After kernels "stew" in the silage juices long enough, they absorb moisture and become softer and fracture more easily. In addition, the protein endosperm that encases the starch granules might become more soluble over time. In any case, kernel passage is usually much less problematic as time passes.

Why does milk production drop when intake does not? Typically kernels make up about 50% of corn silage, dry basis. Milk production decreases because kernels pass through the cow undigested, decreasing the digestibility and energy available from the feed. Often dry matter intake increases as the cow tries to consume enough feed to meet her energy requirements. However, not all cows can increase feed intake enough to account for the lost energy from undigested kernel passage.

Why are the highest producing cows affected the most? Dry matter intake of high producing cows is often limited by the filling effects of the feed. Thus, when these cows consume diets with decreased digestibility, such as with more undigested kernels, they have little ability to eat more. In contrast, feed intake of lower producing cows is often limited by the energy content of the diet; as digestibility decreases, intake increases to compensate, at least until gut fill begins to limit intake. Then, although milk production might not be affected, feed costs will increase because cows eat more feed to produce the same amount of milk.

Why isn't there a slump every year? The slump is usually avoided or reduced in cool years or years in which corn planting is delayed, because corn silage is usually harvested wetter than recommended or harvested at an immature stage after a killing frost. Kernels that have greater moisture content usually are more easily fractured and digested. The slump is more common in years when the corn silage is harvested at the recommended dry matter content.

Why don't we change our recommendations for harvesting corn silage? Harvesting corn silage wetter than recommended results in excessive seepage, higher fiber and lower energy content, and can result in an undesirable fermentation and dry matter intake.

What can be done to eliminate the slump? One way to avoid or reduce the new corn silage slump is to wait several months to open the silo after filling. Although this would require additional storage capacity and a one time cost of increasing forage inventory, the benefits might easily outweigh the costs. The most obvious benefit is prevention of lost milk revenue. Lost production could easily amount to 3 to 4 lb per cow per day over several months if corn silage is 50% of the forage in the diet. A savings of several thousand dollars per 100 milking cows per year is realistic.

There are additional benefits of carrying the extra forage inventory. Dramatic shifts in diets commonly occur when corn silage inventories run out before the new corn silage is harvested. Often diets are switched to all alfalfa silage or green-chopped corn is substituted for corn silage. These abrupt shifts are undesirable and are often the cause of acidosis and laminitis. Alternatively, corn silage might be purchased to fill the gap. However, in years when there has been a forage shortage, this might be a costly alternative because of elevated corn silage prices. Excess corn silage inventory nearly eliminates risk of corn silage shortages allowing more consistent diets to be fed.

Increasing inventory might be done in a year with a bumper crop of corn or in a cool year in which corn planted for grain will not reach physiological maturity. The cost of storing the excess corn silage might be low if packing density can be increased. Studies have shown that packing density and therefore silo capacity can be increased dramatically by increasing the time of packing during filling or increasing the weight of the tractor used to pack. Last year's corn would have to be accessible while the new corn silage is "stewing", requiring more than one silo or the ability to remove silage from both ends of a bunker silo.

Processing corn silage with a roller to crush the kernels might also eliminate the slump. Rolling can be done at harvest with several different commercially available self-propelled or pull-behind choppers or upon removal from the silo with roller mills developed for rolling corn silage. There is some evidence that rolling at harvest might be more advantageous than rolling right before feeding.

Some corn hybrids might be less prone to cause the slump. Hybrids vary in the ratio of kernel dry matter to stover dry matter. Hybrids planted for silage production should have kernels that stay moist and soft while the stover dries down. However, most commercial hybrids have been developed for grain production for which the reverse is desirable: kernels should dry down quickly while the stover retains its moisture. These grain hybrids are most likely to show the new corn silage slump. There is some evidence that other traits of corn silage hybrids affect kernel hardness, and this research will be available in the next few years.

In summary, the new corn silage slump can cause a substantial loss in milk production, but it can be beaten. It is worth investigating the use of one or more of the methods described to increase profitability in your farm.

PRICING PROTEIN AND ENERGY SUPPLEMENTS

The following tables break down the price of the various feed ingredients. Although there may be significant changes in prices as the winter feeding period progresses, the following can be used as a basis for discussion. There may also be some difference in price between feed sources. The first table shows the price/tonne and price/kg of actual protein. The second table shows the price/tonne and price/kg of TDN for various energy supplements. Products marked by * contain added minerals and vitamins and this will have a small effect on overall cost.

Protein Costs

Product	\$/Tonne	\$/kg Protein
46% SBM	305	0.66
34% Canola Meal	165	0.49
32:18 Block* (\$120/90 kg block)	1,333	4.17
32 (20) Pellets*	370	1.16
25% Distillers Grain (corn) ¹	140	0.56
35% Distillers Grains (wheat) ²	NA	NA
16% Alfalfa	90	0.56

\$/kg CP = \$ per tonne / (%CP x 10)

¹ Supply is sold out into 2008.

² No supply available until new Minnedosa plant opens in late November.

Energy Costs

Feed (% TDN, As Fed)	\$/Tonne	\$/kg TDN
Alfalfa (56% TDN)	90	0.16
Barley (73% TDN)	128	0.18
Wheat (79% TDN)	155	0.20
Oats (67% TDN)	173	0.26
Corn (79% TDN)	141	0.18
DDG (corn, 81% TDN)	140	0.17
32:18 Block (67% TDN)*	1,333	1.99

\$/kg TDN = \$ per tonne / (%TDN x 10)

PROPOSAL FOR "NFTA REPLICATED ANALYSIS"

The following article is reprinted with the permission of Dairyland Laboratories, Inc.

Source: www.dairylandlabs.com

The National Forage Testing Association is recommending that forage testing laboratories offer a "NFTA replicated analysis" to improve precision of reported values for better ration balancing and to provide variability estimates facilitate hay buying and selling by indicating that values are estimates not absolute values. The replicated analysis will also give an indication of the accuracy of forage sampling and indicate variability of a lot.

Procedure:

- 1) User agrees to collect three subsamples of hay (take 8 cores and put in 1 sample bag, then another 8 cores to put into the second sample bag and 8 more cores to put into the third sample bag) or silage samples (each with 3 grab samples, as before do not mix subsamples prior to bagging, put each triple of subsamples into a different sample bag).
 - 2) Samples will be submitted to a laboratory for forage analyses.
 - 3) Laboratory will report mean of three sample analyses and standard deviation (not individual values if a discount is given).
 - 4) Laboratory report sheet to have statement: "Standard deviation is the range within which results of fourth subsample submitted to the same laboratory would be expected to occur 68% of the time."
- National Forage Testing Association, forage testing laboratories, National Hay Association and the dairy industry will all aggressively support this as a method of improving accuracy of results, improving understanding of forage analysis and reducing conflict over differing results.

Some additional opportunities:

- 1) A laboratory might flag samples where error is too high, indicating that results might not be good.
- 2) Sampling certification in the future could be dependent on submission of a sample for "super analyses" with a certain low standard error.

Standard deviations will be monitored by Dan Undersander (djunders@wisc.edu), University of Wisconsin. Initial indications are that acceptable ranges for errors are as follows. Nutritionists using the values should consider that the range of error of the three sample means is smaller than the standard deviation (Standard error of mean is standard deviation divided by the square root of number of values in mean eg. 3 if 3 subsamples averaged into the mean).

Table 1 Expected ranges of standard deviations of mean for analytes (DM basis) determined by NIR of three alfalfa hay samples submitted to same laboratory.

<u>Component</u>	<u>Standard Deviation Range</u>
Dry matter ₁	0.5 to 1.5
Crude protein	1.2 to 1.8
Neutral Detergent Fiber	1.5 to 2.5
NDF Digestibility	1.5 to 2.2
Acid Detergent Fiber	0.6 to 1.2
Ash	0.2 to 0.5
Relative Forage Quality	10 to 14

₁ For hay and silage, DM will have larger range.

SOURCES OF VARIATION IN FORAGE AND FEED ANALYSIS

This article was written by Dr. Dan Undersander, Extension, Agronomist, University of Wisconsin-Madison, and is reprinted with the permission of Dairyland Laboratories, Inc. Source: www.dairylandlabs.com

All analytical results are estimates of the actual composition in a lot of feed because only a small fraction of the feed is sampled and analyzed, and there is variation among submitted samples and analyses. Therefore there is variation around each estimate and results should be presented with a standard deviation to estimate the range of variation.

Some important principles are:

1. All analytical results are estimates of the feed actually fed

To illustrate this point, let us assume that we are trying to determine the average crude protein (CP) in a 200-ton stack of bales. The only way to determine the true average CP of the hay would be to analyze every ounce of it. This is impractical so we take a sample from the stack. If we take 20 cores using the correct technique to obtain a representative sample and each core weighs 0.5 ounce, then we have now taken a 10 oz sample to represent what is in 200 ton (1/640,000th of the stack). When this sample is sent to the laboratory, it is ground and a 1-gram test portion is typically analyzed for CP, which is only 1/181,600,000th of the stack. Given the small amount analyzed, there should be little debate that any analysis we obtain is simply an estimate of the average composition in the stack.

2. Variation is natural and unavoidable in any measurement

One of the main factors affecting variation in feed analysis is heterogeneity of forages. Leaves, stems and seeds (grain in corn silage) have quite different chemical composition and the analysis of any test portion will depend on having a uniform distribution of forage components. Samples are ground and mixed to minimize the heterogeneity of samples, but some difference in test portions is unavoidable. This source of variation can be assessed using near infrared reflectance spectroscopy (NIR). With the NIR, exactly the same test portion can be scanned repeatedly to determine the precision of the instrument.

Typically the variation between scans of the same test portion is very low compared to chemical analysis.

3. Variation can be partitioned into accuracy and precision

Accuracy is the constant or uniform average deviation between the average of observations and a true or reference value. Precision is the consistency of repeated observations around their mean or average value. For example, if you analyze a known amount of a pure amino acid, you have a true value that can be compared to the analytical results to determine the method's accuracy.

However, accuracy is less clear for a component like fiber that is determined by the method used to assay it. In this case, no true value is known and results have to be compared to a reference value determined by the average of several measurements. The claim is often made that "My technique must be right because repeated analyses of the same sample agree very well." This claim demonstrates a lack of understanding about the difference between accuracy and precision.

It is quite possible to have an in-house method that is very repeatable, but consistently gets the wrong result. Accuracy and precision are completely independent measures of variation and one tells you absolutely nothing about the other. There can be very precise (repeatable) results that are inaccurate (not close to the true value), and imprecise (inconsistent) results that are accurate on average.

4. Replication and statistical inference are needed to detect differences and provide confidence intervals for analytical results.

Repeated analyses are the key to measuring variation, partitioning it into accuracy and precision, and solving the problem of imprecise measurements. Replication is also the key to determining whether differences between results are significant and to determining the confidence interval around the average that should encompass the true value. Each additional measurement provides additional information that can be used to detect differences

Implications

In general, the variation among laboratories is twice the variation within laboratories. Over a wide range of methods the standard deviation of reproducibility is related to the average concentration of the analyte. The National Forage Testing Association has developed a proficiency certification program that measures the ability of laboratories to accurately and precisely generate results for forage analyses. The names of participating laboratories can be found on the National Forage Testing Association website (<http://www.foragetesting.org/>) and individual laboratories can be contacted to find their grade (closeness to reference method mean). Thus in forage analysis some variation is natural and unavoidable, though analytical variation can be minimized.

